Information Superiority/Battle Command
(Network Centric Warfare Environment)

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Abstract

The Battle Command Battle Laboratory is the U.S. Army's test bed for advanced networking and telecommunications experimentation. Over the past two years the lab has conducted a series of experiments focused on the Army's conceptual Future Force network. These experiments were designed to integrate a myriad of network-related study issues into a technical analysis of future network concepts. The results of these experiments provide the analytical underpinnings supporting the viability of transitioning the conceptual design of the Army's Future Force into an actual warfighting entity.

The Army's Future Force is designed to be a faster, lighter, but more lethal force than today's force. The Future Force will use information superiority as its premier combat enabler. Information superiority coupled with an ultra-reliable networked Battle Command and Control (C2) system will ensure that separate units fight as one. This connectivity and orchestration are performed within a network-centric environment. The Army's view of Network Centric Warfare can be described as the orchestration of integrated successes of its core operational concepts (dominant maneuver, precision engagement, focused/just-in-time logistics, space-to-mud telecommunications, and full dimensional protection), which are all dependent upon information superiority.

Battle Command Battle Lab – Fort Gordon (BCBL-G)

The Training and Doctrine Command (TRADOC) provides the U.S. Army doctrine, organization, training, material, leadership and education, personnel, and facilities (DOTMLPF) support. Among its chartered taskings, TRADOC recruits, trains, and educates the Army's soldiers; develops leaders; supports training in units; develops doctrine; establishes standards; and builds the future Army. As a mission partner of TRADOC, the U.S. Army Signal Center (SIGCEN) at Ft. Gordon, GA is the lead organization for supplying DOTMLPF expertise in the areas of tactical communications and networking. The SIGCEN primarily conducts specialized communications instruction for all Signal Regiment military and Department of the Army civilian personnel. The Battle Command Battle Lab-Gordon (BCBL-G) is a subordinate organization of the SIGCEN. The Battle Command Battle Lab – Gordon was chartered in December 1994 and is missioned to enhance TRADOC's ability to practice the art and science of Battle Command. The mission of the Battle Command Battle Lab – Gordon is to provide overall direction, oversight, vertical and horizontal integration of all activities that are focused on

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providing the means to improve and merge Battle Command and information warfare capabilities.

The BCBL-G's responsibility is to investigate, leverage, and adapt current commercial and military technologies to the current and Future Force (FF). This responsibility encompasses all related combat and force development efforts required to enhance the Army's capabilities, operational effectiveness and achievement of a delta of effectiveness in information warfare over potential adversaries. The BCBL-G is empowered to be the technical integrator of all Battle Lab Command, Control, Computers, and Communications (C4) initiatives to ensure compliance with interoperability standards, protocols and message formats within the Army. Moreover, the BCBL-G has the authority to conduct direct coordination and information exchanges with industry, academia, Army MACOMs, the National Labs, and other Department of Defense (DoD) agencies.

Specifically, BCBL-G focuses its efforts on technology and doctrine, which will allow units conducting combat operations in the most compartmentalized terrain environment to continue communications and collaboration without stopping their vehicles to establish connectivity. This concept is known as Battle Command on the Move (BCOTM). To this end a multiplicity of subtasks have been articulated to include:

1) Evaluate future data radio, wireless, personal computer system, conformal antennas, co-site reduction and mobile SATCOM technologies
2) Optimize space-based systems for Battle Command and information operations
3) Focus on technologies that will mitigate the Army's near total dependence on terrestrial line of site systems
4) Improve and streamline C2 and communications interoperability with joint and coalition forces
5) Focus on C2 automation interoperability, coordination and planning, joint targeting interoperability, joint airspace management, situation awareness, data network interoperability and management
6) Optimize broadcast technology to enable units to receive critical, time-sensitive information
7) Optimize Combat Service Support (CSS) battlefield automation and communications support
8) Influence the DoD technology base to align Research and Development (R&D) efforts to Battle Lab and user requirements and concepts
9) Influence Industry R&D (IR&D), leverage commercial and dual use technology to the maximum extent possible.

The BCBL-G is also part of a triad of laboratory elements supporting the development of Battle Command. It focuses on the communications and network capabilities essential to providing the means to conduct Battle Command. The other supporting elements are located at Fort Leavenworth and Fort Huachuca. The Fort Leavenworth lab is responsible for providing overall direction and integration of all activities relating to the art and science of battle command and information operations. The Fort Huachuca lab is responsible for direction and oversight of intelligence and electronic warfare and command and control warfare.

Figure 1: Army TRADOC Battle Command Triad

Network Centric Warfare

The concept of Network Centric Warfare (NCW) was introduced in 1997 by the Chief of Naval Operations (CNO) N6, VADM Arthur Cebrowski, as an information and intelligence architecture built around sensors, information, and engagement grids that would enable new operational concepts of speed of command and self-synchronization.[1] NCW had as its genesis the 1996 Chairman of the Joint Chiefs of Staff vision for future warfighting capabilities as expressed in *Joint Vision 2010*. In *JV 2010* the concept of information superiority (battlespace awareness, information operations, information superiority and processing) transformed the traditional battlefield functions of move, strike, protect, and sustain into the operational concepts of Dominant Maneuver, Precision Engagement, Full Dimensional Protection, and Focused Logistics.[2]

The development of the distributed computing environment in the business world provided the seed for the development of NCW. In the 1960's and 1970's, computing and processing power resided with computers manufactured by International Business Machines (IBM) and Honeywell, which resulted in a mainframe-centric model. In the 1980's, the Personal Computer (PC)- centric environment, replaced the mainframe-centric environment. The PC made the power of computing available to the masses. However, the downside of the PC-centric approach was the proliferation of stovepipe operating and application systems. Since the late 1990's, the PC-centric approach has been migrating towards a network-centric approach where applicable PC's in a defined distributed computing environment share applications and data.

In essence, the NCW approach as it applies to the military can best be defined as "an information superiority-enabled concept of operations that generates increased combat power by networking sensors, decision makers, and shooters to achieve shared awareness, increased speed of decision-

making and command, higher tempo of operations, greater lethality, increased survivability, and a degree of self-synchronization."[4]

The NCW paradigm is a shift from the platform-centric theory of warfare to network-centric warfare. Platform-centric warfare (PCW) was based upon overpowering and destroying enemy forces with the aim of removing their courses of action due to a lack of material strength.[5] In platform-centric warfare the sensor, shooter and often times the decision maker are the same platform.

In NCW the paradigm shifts from independent platforms of sensor, shooter, decision maker to the networked entity of sensors, shooters, and decision makers. Without the mass associated with conventional styles of warfare, maneuver and information warfare become the keys to NCW. The focus of maneuver warfare is to gain positional advantage over enemy forces, typically using speed and surprise, to abrogate the enemy's courses of action. Maneuver warfare as defined in Joint Publication 1.02 is "…the employment of forces on the battlefield through movement … to achieve a position of advantage with respect to the enemy in order to accomplish the mission."[6] In NCW platforms, shooters, and decision makers are physically separated but are linked via a ubiquitous network, which facilitates maximizing the utility of information superiority. This implies that the focus of NCW is on the behavior of networked entities rather than on individual entities evident in PCW.[7] The nature and extent of accessibility, collaboration and interaction among the different friendly entities in physically separated locations generate the power of NCW.[8]

However, the biggest difference between PCW and NCW is the emphasis of NCW on the non-tangible collective attributes of leadership, individual morale, unit cohesion, situational awareness, information transport and processing. In PCW the emphasis is on the quantifiable and measurable factors such as probability of kill, blast rates, and tonnage.[9] With NCW the emphasis shifts from platforms such as planes, tanks, and ships to capabilities such as the speed of the military decision making process with the aid of technology, processes, and organization. This is the challenge of Battle Command in the future; to integrate the concepts of NCW into the processes that drive current and Future Forces.

One can observe from Operation Iraqi Freedom (OIF) the early germination of the principles of NCW. For example, Blue Force Tracking (BFT) provided for the first time in modern military history "real-time" ground locations of friendly and known enemy forces. BFT provided the warfighter a user-friendly view of the disposition of friendly forces and known enemy targets, as well as forces to the left, right, front, and rear. Throughout the conflict this plethora of information was provided to the warfighter in a secure and reliable manner. Additionally, authorized organizations were receiving the Unmanned Aerial Vehicle (UAV) real time video feeds which provided the combat leadership with incredibly timely intelligence to facilitate their military decision making process.

The BCBL-G is uniquely configured to participate in the development of NCW. It has the resources and expertise to uncover and validate critical insights as it exploits it's capabilities to model and simulate important aspects of the combat environment, conduct concept experimentation and insights development, and facilitate near-term technology insertion.

Modeling and Simulation

How does Modeling and Simulation (M&S) support this challenge? The BCBL-G is designing a communications planner called the Network Planning and Simulation Toolset (NPST). The NPST is used to integrate realistic communications effects into the TRADOC Modeling and Simulation (M&S) environments. Developing communications and networking models and simulations that accurately portray the network effects is critical to the achievement of NCW. Foremost, it provides the means in which a realistic assessment can be made of the impact on network connectivity of the multitude of variables and conditions present in the combat environment. This information can be made immediately available to the decision makers. Furthermore, the employment of communications realism, visualization, performance analysis, Course of Action (COA) development, and execution monitoring in a simulated environment is necessary to understand the Battle Command interactions among the battlespace entities. Integration of the NPST into the overall experiment program permits the battlespace entities to inter-relate as they would on an actual battlefield. For example, the NPST was used as a technology demonstrator in the Future Force Concept Experimentation that is addressed later in this paper. Figure 2 is an example of an NPST screen shot showing predicted communications coverage.

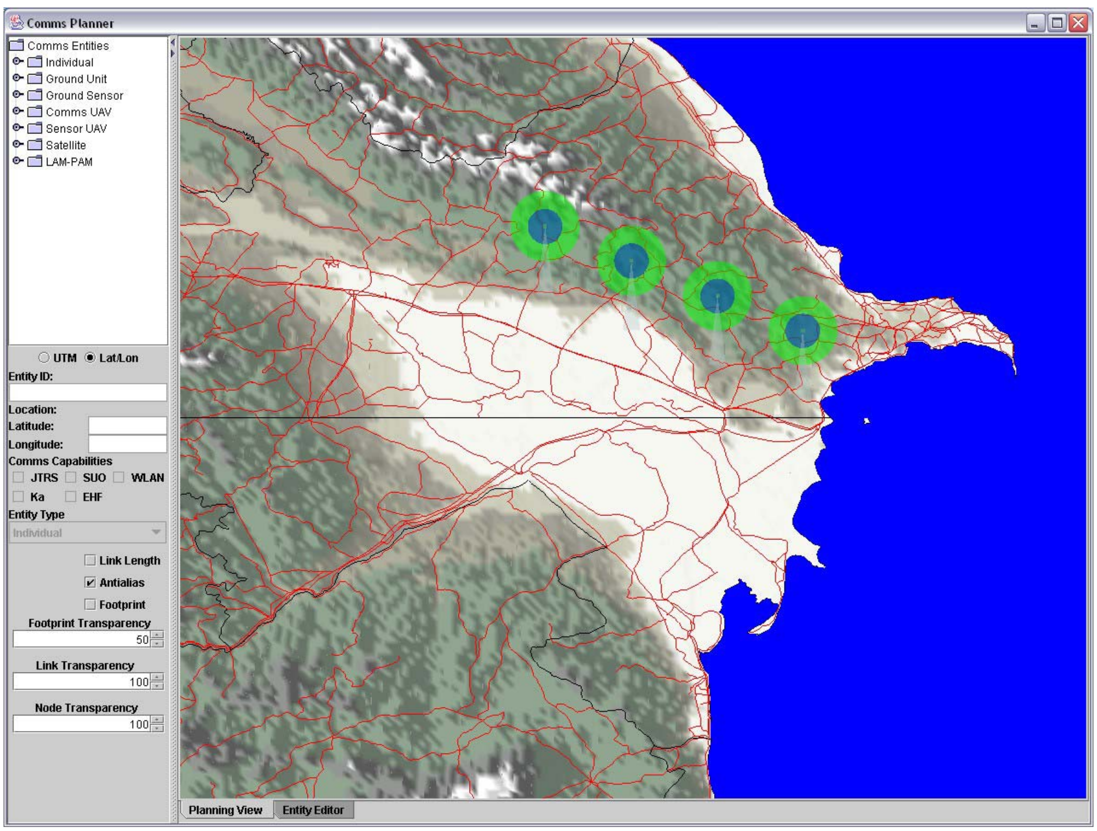

Figure 2: NPST Display

The ultimate payoff will be to deliver to the warfighter a methodology to effectively plan and fight the communications network before and during the battle, as well as provide decision tools to compensate for less than optimal network performance. The NPST is in development and is being designed to act in a stand-alone mode, as well as in a federated mode that will serve both current and future M&S experiments. A beta version of the NPST was delivered to the Unit of Action Maneuver Battle Lab (UAMBL) test facility at Fort Knox, KY for testing and experimentation. As a result of the UAMBL experimentation, the decision was made to develop a formal Science and Technology Objective (STO) request with the Communications-Electronics Command (CECOM) Science and Technology Development (S&TCD) for a collaborative effort on further NPST development.

Battle Lab Collaborative Simulation Environment (BLCSE)

The BLCSE project was designed to digitally network and integrate TRADOC Battle Labs and Branch proponents (Figure 3). This connectivity enables remote collaboration, routine virtual teaming, and distributed M&S. It is also capable of deploying nodes to extend network connectivity to link warfighter simulations and exercises. The BLCSE performs the role of the Army's gateway to Joint experimentation by providing a link to the other DoD services and the Distributed Continuous Experimentation Environment (DCEE). The BLCSE integrated environment is perfectly suited to support the development of "system-of-systems" combined arms capabilities across the Army, as well as for Joint operations. Enabling network-centric experimentation within TRADOC via the execution of the BLSCE Network Operations and Security Center (NOSC) functions is a key role for the BCBL-G.

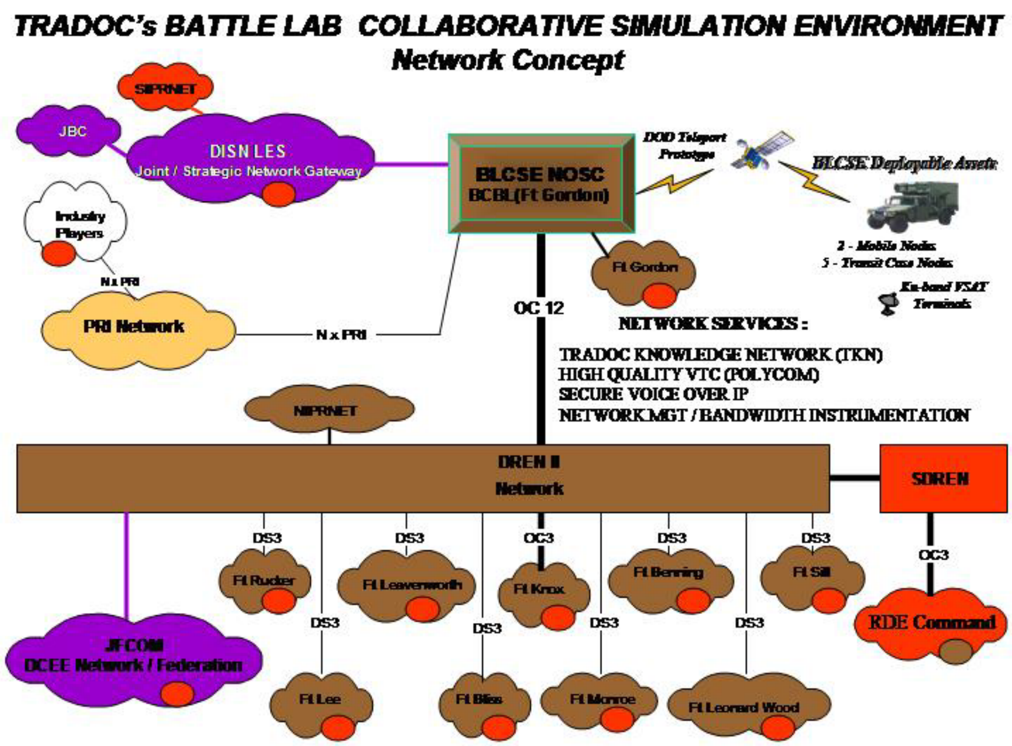

Figure 3: BLCSE Network Diagram

Future Force Concept Experimentation

The BCBL-G supports TRADOC in the development of the networking and communications aspects of the Future Force through concept experimentation and insights development. The Future Force is conceptually a NCW enterprise in which its success during combat is inextricably link to the "goodness" of the network and the reliability of pertinent information getting to the right users at the right time. The intent of the TRADOC Concept Experimentation Program (CEP) is to provide insights on Future Combat Systems and Future Force network issues, specifically stated as Essential Elements of Analysis (EEAs) in the TRADOC study plan. The results from the study of the EEAs provide input and support to the development of the Unit of Action (UA) Operational and Organizational (O&O) plan. The UA is equivalent to a Brigade sized unit in today's Army but much more self-sufficient operationally. The O&O plan is the document, which encapsulates the role and function of the UA and its subordinate components. All of the insights and data points from the CEP provide the analytical underpinnings to drive requirements for the Future Force network, and will ultimately assist in the development of network related DOTMLPF requirements for the Army's Future Force. As a result of the TRADOC CEP initiative, the BCBL-G developed an experimentation campaign plan to first address the overall tactical communications network. Subsequent experiments refined how the UA communications network is operated and what network tools and functions are required to manage the network.

The overall tactical communications network was first examined using a map-oriented exercise (MAPEX) (Figure 4). This was a discovery experiment to consider the interactions of components of the UA tactical communications network. Ultimately, the purpose of the MAPEX was designed to uncover specific DOTMLPF insights associated with emerging Future Force (FF) and Future Combat Systems (FCS) concepts. The design effort for the Network MAPEX was a collaboration among a wide array of personnel and organizations throughout the TRADOC organization. The body of work prior to the conduct of the MAPEX consisted of the development and refinement of the EEAs and associated Measures of Merit (MOM) to be investigated during the MAPEX. The BCBL-G provided the coordination of the design effort and developed everything from the rules of engagement to the exercise playbook. The SIGCEN Subject Matter Experts (SMEs) provided the set of network assumptions based on a 2015 timeframe. The Blue Force and maneuver scheme for each scenario to be studied was designed and briefed by Booz, Allen and Hamilton who were contracted through the Unit of Action Maneuver Battle Lab (UAMBL) at Fort Knox.

The Network Operations (NETOPS) experiment was the second experiment in the BCBL-G's Future Force network campaign plan to examine the UA network. The experiment was again conducted in a MAPEX environment at the BCBL-G. This time the focus of the experiment was on UA NETOPS, encompassing all functionalities of NETOPS: network management, information assurance, information dissemination management and spectrum management. The experiment objective was to continue providing insights and input on UA and FCS EEAs, which was the basis for the input to the refinement of the UA O&O. The UA NETOPS MAPEX examined the process of how the network enables Battle Command for the UA Commander. The BCBL-G coined the phrase of "fighting the network" in which options for the configuration,

maintenance, and employment of critical network attributes were evaluated with the context of combat scenarios.

The analytical focus addressed the study from the perspective of a subordinate unit of the UA known as the Brigade Intelligence Communications Company (BICC). The BICC is responsible for the network requirements of the entire UA. Again, the experiment environment was based upon technical forecasts and projections of future network capabilities. The technical design effort for the NETOPS MAPEX was conducted by the collaboration of several external organizations. The experiment took place as scheduled, with participation from other Battle Labs, CECOM RDEC, Lead Systems Integrator (LSI), and Blue Force contractor support.

Figure 4: MAPEX Experimentation

The third experiment of the BCBL-G campaign plan was the UA NETOPS Tools and Functions experiment. The BCBL-G developed a plan for five separate events. The purpose of the experiment was to determine what types of NETOPS tools and what kinds of functions could be projected for the UA BICC as it performs NETOPS in support of the UA commander. The initial planning meetings were made up of a core group of Signal Center SMEs who were tasked to develop EEAs and MOMs as study issues. The first event for the experiment was an Analysis Review Workshop. The EEAs, Measures of Effectiveness (MOEs) and Measures of Performance (MOPs) were developed during the review workshop, refined, and published as an update to the Experiment Plan. The second event of the experiment was the Network Planning and Simulation Toolset (NPST) workshop that determined the rudimentary functions available in the NPST. This was followed by the NPST beta test, which lasted for three weeks. Next, the BCBL-G hosted a Rock Drill, which was the dry run for the capstone MAPEX in December. During the event, participants refined the scenario snapshots to be used during the MAPEX and refined the data collection plan by revising the survey questions. The MAPEX in December was

again designed as a scenario-based MAPEX with an appearance of the NPST as a technology demonstration. Here the NPST was used to display the network disposition of selected company and battalion UA units. The NPST highlighted gaps in terrestrial communications and helped initiate discussion on what tools and functions must be available to plan the UA network effectively within the context of the demonstrated terrain environment (Figure 2). The group opinion was that the NPST interface was effective and development should continue toward implementation in much larger integrating experiments to be conducted at Fort Knox later in 2004. Additionally, Information Dissemination Management-Tactical (IDM-T) was demonstrated to illustrate one method for conducting collaboration and information sharing expected to take place on the future battlefield. IDM-T, also serving as a technology demonstration, helped facilitate the discussion of the functionality of an IDM system required in the UA.

Insights from these experiments number in the hundreds and are summarized in the paragraphs below[10]:

1) In order to be prepared to fight off the aircraft ramp immediately after the aircraft lands, through the pursuit and exploitation of enemy forces, the BCBL-G MAPEX's highlighted the requirement for UA elements to have ultra-reliable situational awareness via the Common Operational Picture (COP). The BCBL-G concluded that the UA communications network is wholly dependent on Joint, Interagency, and Multi-National (JIM) communications and networking assets, which are external to the UA for network connectivity and robustness. In each MAPEX vignette, access to external assets such as satellites or a high-flying UAV, such as Global Hawk, was required to extend the UA network beyond its own boundaries. A true and accurate COP could not be provided to the warfighter without this external network communications that would have to be managed and coordinated by Signal Corps personnel.
2) Dedicated all weather communications relay platforms, whether they were incorporated into an UAV or a FCS platform such as an Unmanned Ground Vehicle (UGV) or Multifunctional Utility/Logistics and Equipment Vehicle (MULE) are required at all echelons of the UA to provide network connectivity or to ensure extended network capability. This insight was repeated in all MAPEX's. In the NETOPS MAPEX several UAV CRP's were required to ensure extended network connectivity for an air assault mission. Moreover, dedicated CRP's were required for keeping the air assault commander and the maneuver commander in touch with higher headquarters and other ground forces, which were moving toward the objective location. In the urban fight experimentation, which is a spectrally complex environment, a dedicated communications relay was identified as critical to provide the COP to friendly forces required to operate in many environments to include subterranean. Subterranean communications relay packages presented particular issues with Blue Force tracking and precision engagements. The extended distances and rapid movement of the exploitation demonstrated that both air and ground CRP's were required to keep pace with ground operations or to link remote re-supply locations.
3) The communications network identified by the term "info-sphere" is an all-pervasive asset in the UA. As a result, all soldiers, especially non-signal soldiers, need to possess some level of trouble-shooting and maintenance network skills. The possession of a

network skill set was especially critical in the urban operations where soldiers would be peering around and in buildings. Here soldiers need to understand why they will be using remote sensors linked by communications assets that would require line-of-sight and why the technology may be susceptible to multi-path interference from urban structures. Additionally, the individual soldier would have to be cognizant of network communications issues to ensure the COP is being accurately updated or the information being provided to the COP database is not impeded, corrupted, inaccurate, or untimely. In addition to providing networked communications, the Signal Corps soldier skill set should also include aerial communications relay mission planning to understand the complexity of implementing dedicated aerial communications relay profiles.

4) The NETOPS MAPEX and the NETOPS Tools and Functions MAPEX supplied insight into the need for a network planning and visualization tool. This tool would be used to maintain the situational awareness of the network relative to the warfighter COP. This tool must also allow network planners and managers to see in real time the status of the UA network and to provide network situational awareness. This tool must provide the ability to run network simulations that closely approximate the actual UA network in all its complexity. It will act as a decision aid tool for network planners to evaluate future network-oriented courses of action. This network visibility should be available to all soldiers but especially to the Signal Corps soldiers who are responsible for planning, implementing, operating, and maintaining the network. Given the exceptionally complex nature of the transmission and communications networks and information systems in the UA, there is no way the limited number of network managers in the Information Superiority Cell and the NETOPS operations teams will be capable of managing all aspects of NETOPS. NETOPS is a fusion of Network Management (NM), Information Dissemination Management (IDM), and Information Assurance (IA). Each of these components of NETOPS is very complex in their own right, and when combined into one operational construct, the level of complexity increases manifold. It is for this reason that NETOPS functionality must operate autonomously and must be managed only by exception.

Technology Insertion

Beginning in September 2003 the BCBL-G, in concert with Program Executive Office-Command, Control, and Communications, Tactical (PEO-C3T), was tasked to recommend a technical solution for the 1st Stryker Brigade Combat Team (SBCT) operational requirements for Beyond Line-of-Sight (BLOS) communications and collaboration support prior to its deployment overseas. The BCBL-G recommended solution was developed quickly as a result of the Time Division Multiple Access (TDMA) SATCOM experimental concept body of work performed and documented by BCBL-G in 2002. BCBL-G had successfully prototyped, designed, and deployed a TDMA SATCOM architecture and hardware configuration to support the Joint Forces Command (JFCOM)-sponsored Millennium Challenge 2002 (MC02) exercise. Using a VSAT (Ku- Band) technology as the baseline concept, the BCBL-G worked in coordination with PEOC3T and the 1st SBCT to design an architecture and hardware configuration for the mission. Concurrently, the BCBL-G SATCOM team provided an interim DOTMLPF solution to include integration, training, and logistical support to ensure success of the mission (Figure 5). The BCBL-G support team provided this BLOS communications and collaboration enhancement

solution for the 1st SBCT even with the constraint of a reduced timeline. In addition to meeting the technical solution goal, the BCBL-G team met every milestone for the deployment schedule. The BCBL-G team provided on-site initial pre-deployment training at Fort Lewis, WA where the final training exercise configuration consisted of a six-node satellite network with eight Linkway modems. When the network was operational, the soldiers practiced Main Reference Terminal (MRT) to Alternate MRT handover. Ultimately, the BCBL-G SATCOM team deployed overseas to provide hands-on training to the SBCT. The BCBL-G SATCOM engineering team and soldiers finalized the backside data architecture and deployed with the SBCT to continue training and testing of the TDMA equipment while the SBCT soldiers prepared for their final deployment. For the first time ever in a combat environment, battalion elements had access to multimedia products via a broadband SATCOM system.

Due to the success of the 1st SBCT technology insertion effort, the BCBL-G hosted a systems level training event for the Automated Network Information Flow (ANIF) pilot fielding to USTRANSCOM at the BCBL-G facility. ANIF is a Joint Requirements Oversight Council (JROC) approved initiative, which integrates TDMA Demand Assigned Multiple Access (DAMA) satellite communications, and Internet Protocol Quality of Service tools to produce a bandwidth-friendly, full mesh satellite wide area network. The ANIF training event was the capstone event for the technology fielding. The ANIF fielding was a JFCOM J8 Joint Interoperability and Integration (JI&I) sponsored program with BCBL-G acting as its executing agent. For the ANIF pilot fielding, BCBL-G was responsible for equipment procurement, ANIF communications suite integration, training, and overall subject matter expertise. Six ANIF suites were developed including one that was designed for use at Teleport sites. A live satellite communications network was established using the six ANIF suites. USTRANSCOM provided their own satellite terminals including the USC-60, DDT, Safari, and Mantis VSATs. USTRANSCOM also provided their Theater Deployable Communications (TDC) base band suites of equipment that were integrated with the ANIF suites. The BCBL-G 4.5 meter antenna was used as a Teleport reachback. Full mesh IP voice, H.323 video, and data services were established including reachback services from the BCBL-G teleport facility. The satellite wide area network was provisioned using 5 MHz of satellite bandwidth. The bandwidth acted as a pooled resource, which was shared among the six sites in an on-demand and prioritized manner.

Figure 5: TDMA SATCOM

Conclusion

The role of the BCBL-G is to ensure network-centric capabilities for the Future Force are tested and proven to enable and insure success on the battlefields of tomorrow. The charter is to continue to experiment with emerging technologies and advanced networking concepts to determine the best solutions for the Future Force as well as for transforming the Army of the near term. Warfighters demand information superiority and information dominance. To this end, the BCBL-G will provide the means to bridge capability gaps in the current force as well as for acquisition of future technologies.

Footnotes:

1. CAPT Karl Hasslinger, USN (Ret.) and others, *Measuring the Effects of Network Centric Warfare, Exploring Belief Metrics in Warfare,* (Washington, 2002), pg. 7.
2. Ibid., pp. 6-7.
3. *IT Boot Camp*, Global Knowledge M3300C-002, North Carolina, 2002, pp. 3-4.
4. David S. Alberts and others, *Network Centric Warfare, Developing and Leveraging Information Superiority 2nd Edition Revised*, (Washington, 2002), pg. 2.
5. CAPT Karl Hasslinger, USN (Ret.) and others, *Measuring the Effects of Network Centric Warfare, Exploring Belief Metrics in Warfare,* (Washington, 2002), pp. 22-23.
6. Ibid., pg. 24.
7. David S. Alberts and others, *Network Centric Warfare, Developing and Leveraging Information Superiority 2nd Edition Revised*, (Washington, 2002), pg. 105.
8. Ibid., pg. 115.
9. CAPT Karl Hasslinger, USN (Ret.) and others, *Measuring the Effects of Network Centric Warfare, Exploring Belief Metrics in Warfare,* (Washington, 2002), pg. 25.
10. COL Yavorsky, Joseph and Hamilton, Mike "Unit of Action Network MAPEX: Testing the Network in a Virtual Warfight," *Army Communicator*, Vol. 28 No. 2 (Summer 2003), pp.7-11.

Information Superiority
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What is the US Army doing?
Paper 123

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Agenda

- Network Centric Warfare
- Introduction to Battle Command Battle Laboratory (Gordon)
- BCBL-G contribution to developing US Army Network Centric Warfare capability
  - Modeling and Simulation
  - Battle Lab Collaborative Simulation Environment (BLSCE)
  - Future Force Concept Experimentation
  - Technology Insertion

Network Centric Warfare

- 1997, VADM Arthur Cebrowski
  – Information and Intelligence architecture built around sensors, information, and engagement grids that would enable new operational concepts of speed of command and self-synchronization.

Military Network Centric Warfare Approach

- An information superiority-enabled concept of operations that:
  - generates increased combat power by networking sensors, decision makers and shooters to achieve shared awareness,
  - increased speed of decision making and command, higher tempo of operation, greater lethality,
  - increased survivability, and
  - a degree of self synchronization

Network Centric Warfare Paradigm

- Shift from platform centric warfare based upon overpowering and destroying enemy forces with the aim of removing courses of action due to a lack of material strength.
- NCW focus on non-tangible collective attributes:
  - Leadership, individual morale, unit cohesiveness, situational awareness, information transport and processing.

BCBL(G) Mission

Provide overall direction, oversight, vertical and horizontal integration of all activities that are focused on providing the means to improve and merge Battle Command and information warfare.

BCBL-G Responsibilities

- Investigate, leverage, and adapt emerging commercial communications and battle command automation technologies, capabilities and concepts that *support* the current and Future Force

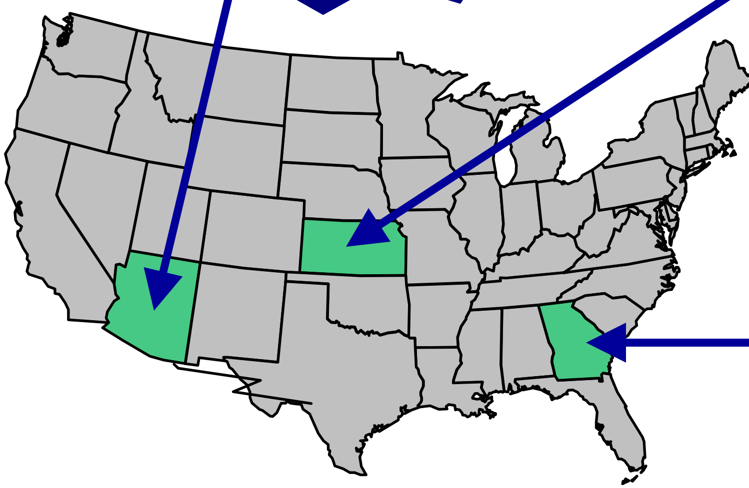
Battle Command Triad

FT. HUACHUCA, AZ
FOCUS on :
The "INTEL" of Battle Command

Technology Solutions
Intelligence Capabilities

FT. LEAVENWORTH, KS
FOCUS on :
The "ART" of Battle Command

(C2) Rqmts
Desired Capabilities
CP Structure / Organizations

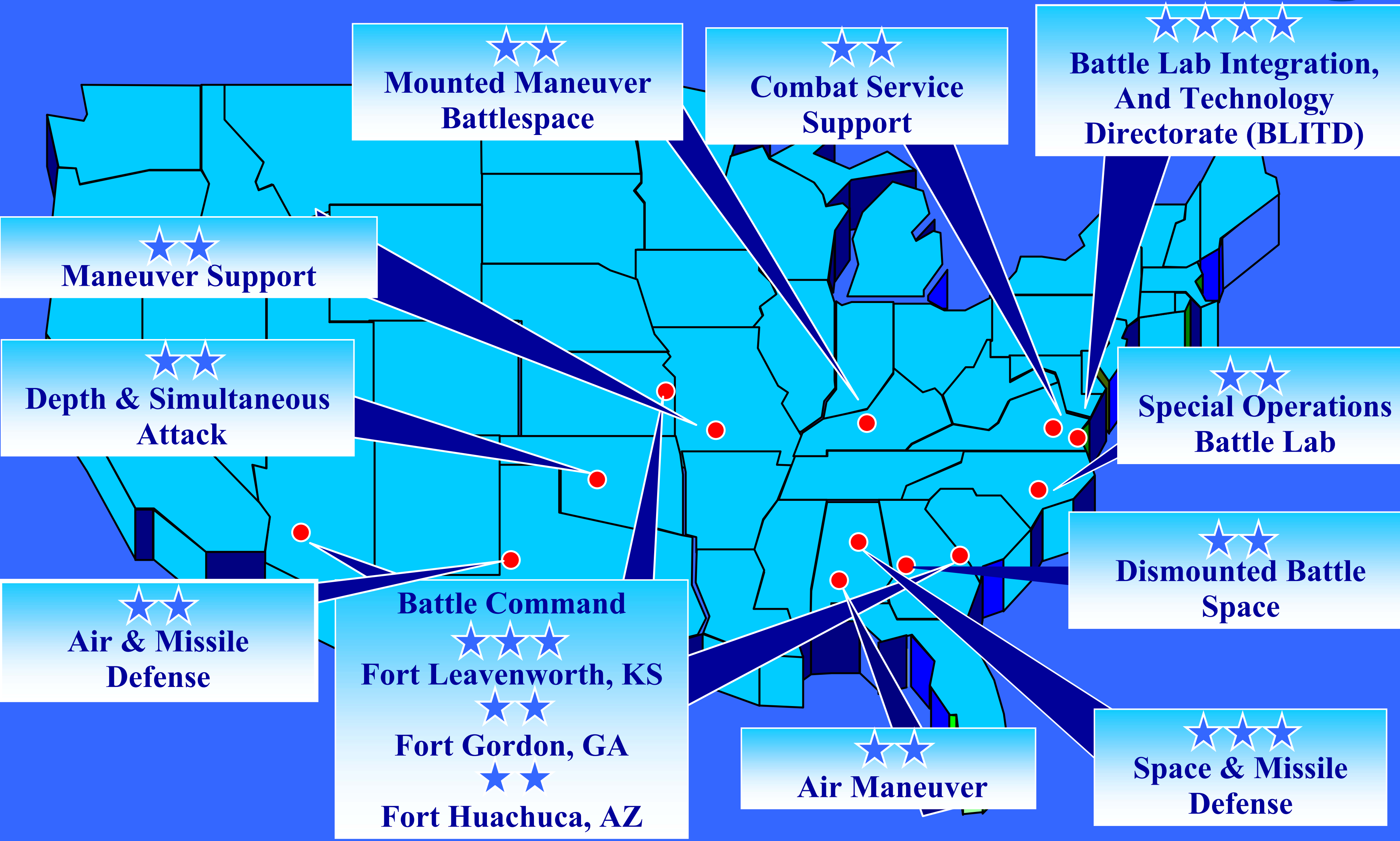


FT. GORDON, GA
FOCUS on :
The "MEANS" of Battle Command

Technology Solutions
C2 Standardization
Information Systems
Networks / Protocols

Fort Gordon BCBL(G) is the TRADOC executive agent for the "means" of BC and technical integration of Information Networks (Army & Joint)

Army Battle Laboratories



Modeling and Simulation

- Developing communications and networking models and simulation that accurately portray the network effects is critical to the achievement of Network Centric Warfare.

NPST Mission and Vision

MISSION:

- To provide a Network Management, Planning & Simulation toolset that models and predicts network performance within Future Force experiments.
- To provide Warfighter Signal Staff with a toolset that allows the staff to plan, monitor and maintain the health of the network in support of the Commander's scheme of maneuver during Future Force experimentation.

TRANSITION VISION

- Transition proven NPST functionality to WIN-T, JTRS, & FCS Network Management programs of record.

BATTLE LAB COLLABORATIVE SIMULATION ENVIRONMENT (BLCSE)

- TRADOC Battle Labs & Branch proponents digitally networked & integrated.
  - Enable collaboration, routine virtual teaming (voice, VTC, whiteboard, & TKN)
  - Enable distributed M&S, link Warfighting simulations and experiment events
  - Deployable network for experimentation / integrating virtual & live Force play
  - Gateway for Joint experimentation / link to DCEE and other Service labs
  - Gateway to technology base (CECOM, SPAWAR, ROME Lab, etc) & industry

- Integrated environment to support development of systems-of-systems combined arms capabilities across the Army and in support of Joint operations, optimized for Future Force Development:
  - Validate / refine O&O, OA/SA, MNS, ORDs
  - Get at KOC (Deployability, C4ISR, NetFires, LOS/NLOS, Mounted/Dismounted Ops)
  - Bridge capability gaps between Current, Stryker, Future Force

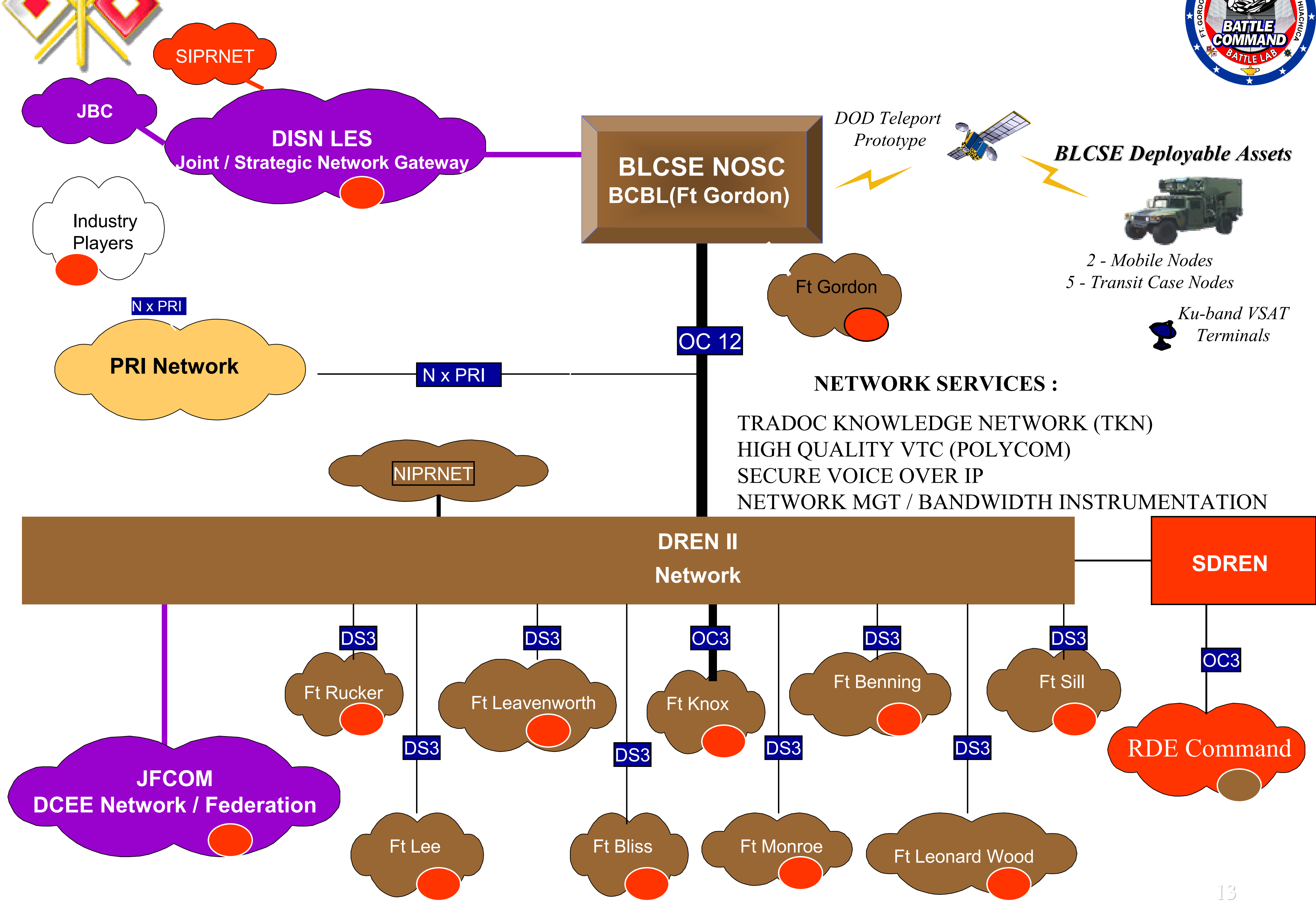
Enabling Network-Centric Experimentation within TRADOC

And

Execution of BLCSE NOSC Functions

Are Key Roles For SIGCEN

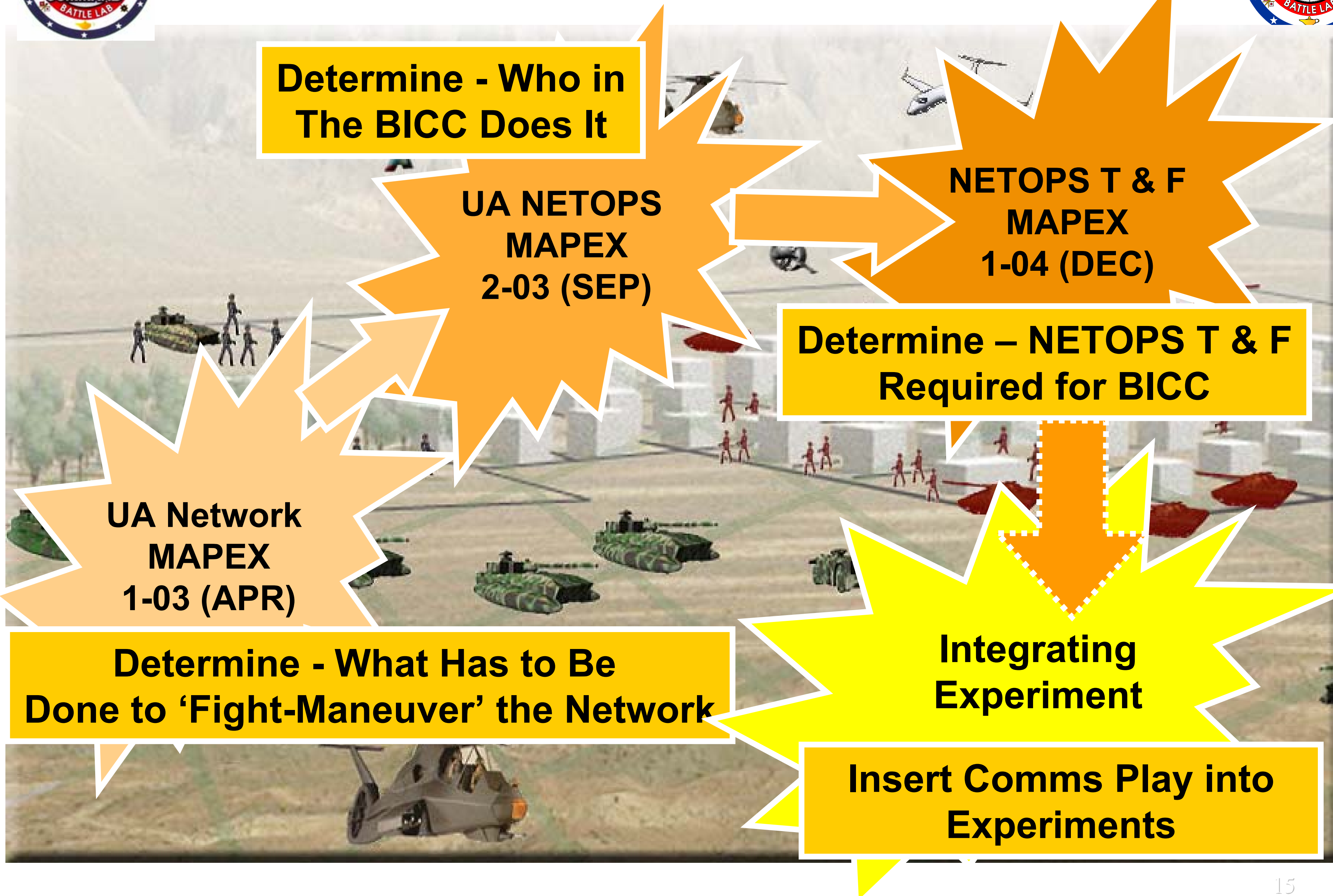
TRADOC's Objective (BLCSE) Network Concept (FY04)



Future Force Concept Experimentation

- Future Force is conceptually a Network Centric Enterprise in which success in combat is linked to the “goodness” of the network and the reliability of pertinent information getting to the right user at the right time
- Experimentation provides insights for Future Combat Systems and Future Force Issues including the Network.

BCBL(G) UA Network Campaign Plan



Future Force Experimentation Key Insights

- Ultra-reliable situational awareness via the Common Operational Picture relies on Joint, Interagency and Multinational Communcations Systems.
- Requirement for Dedicated All Weather Communications Relay platforms.
- Requirement for Higher level of Networking skills for all soldiers.
- Requirement for Network Planning and Simulation Tool.

Technology Insertion

- 1st Stryker Brigade Combat Team Beyond Line of Sight Communications Capability

1SBCT Ground Segment

- Ground segment consists of Very Small Aperture Terminals (VSAT)
- Operates in Ku band (11-14 GHz)
- Reference Terminals use 2.4m flyaway
  - 9 transit cases for antenna
  - 3 transit cases for electronics
- Traffic Terminals use 1.5m flyaway
  - 3 transit cases for antenna
  - 2 transit cases for electronics
- Both use 16W solid state PA and LNB.

Ground segment provides outstanding mix of mobility, reliability and performance to provide wideband comms to the tactical warfighter.

1SBCT TDMA Services

- 1SBCT TDMA network provides internal broadband services
  - Red VoIP to all sites
  - Black VoIP to select sites for in-band orderwire
  - Data pull from Bde Web server
  - Supports 10 node BVTC conference
- External linkage currently provided by 4th ID
- Optionally, data services could be provided by Camp Doha
  - Better reliability
  - Less congestion
  - Less latency

TDMA Equipment

Master 2.4m antenna – Camp DOHA

Bde Main 2.4m antenna

Traffic Terminal 1.5m antenna

Master Reference Terminal Electronics

Traffic Terminal Electronics

Conclusion

- Introduction to Battle Command Battle Laboratory (Gordon)
- Network Centric Warfare
- BCBL-G contribution to developing US Army Network Centric Warfare capability
  - Modeling and Simulation
  - Battle Lab Collaborative Simulation Environment (BLSCE)
  - Future Force Concept Experimentation
  - Technology Insertion

Questions/Comments ?

Backup Slides

OBJECTIVE 3-2 SBCT DEPLOYMENT COMMUNICATIONS ARCHITECTURE WITH DIGITAL RANGE EXTENSION ASSESTS DEPLOYED TO BATTALION LEVEL WITH A TDMA Ku BAND SATTELITE SOLUTION

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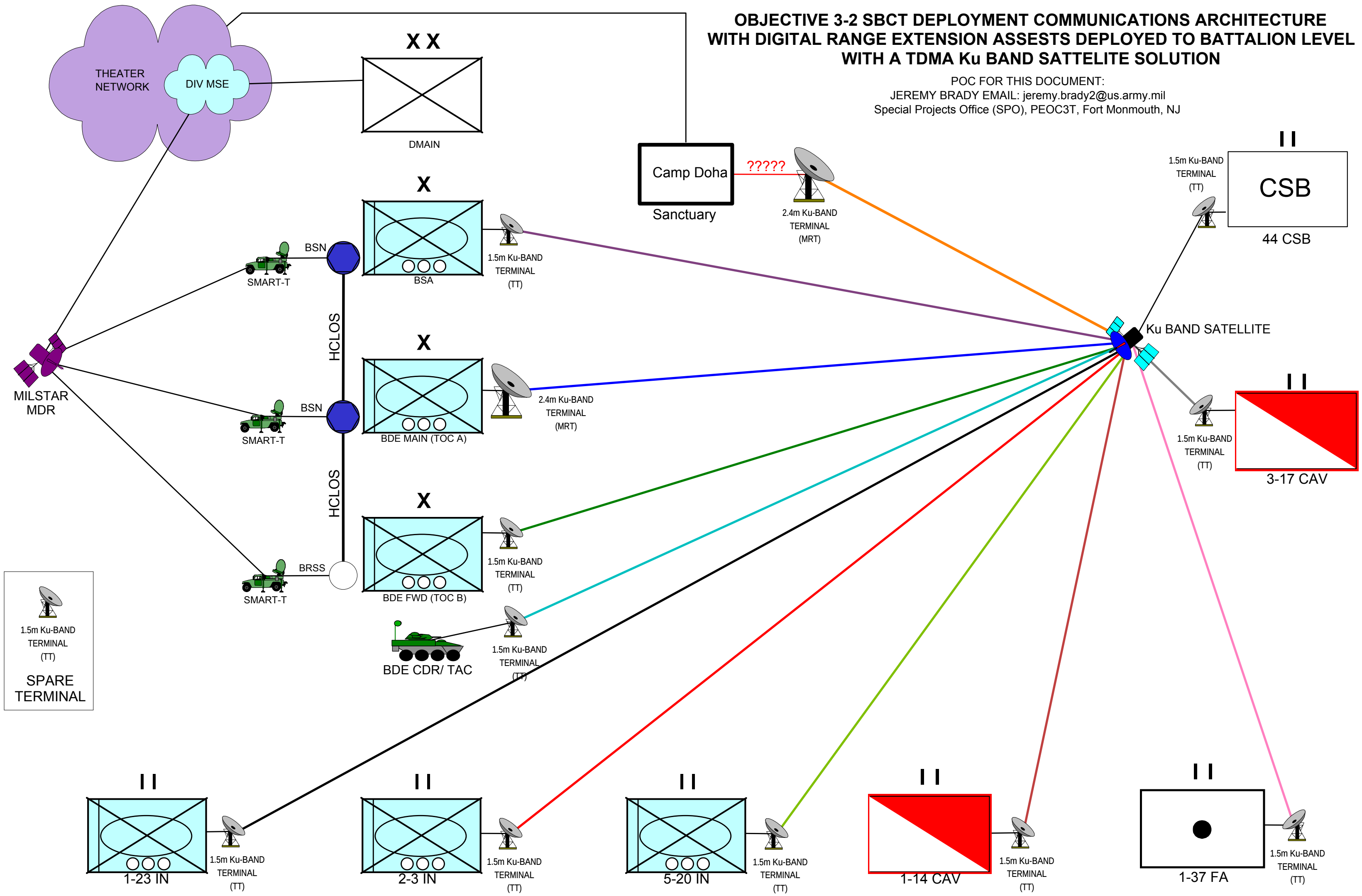
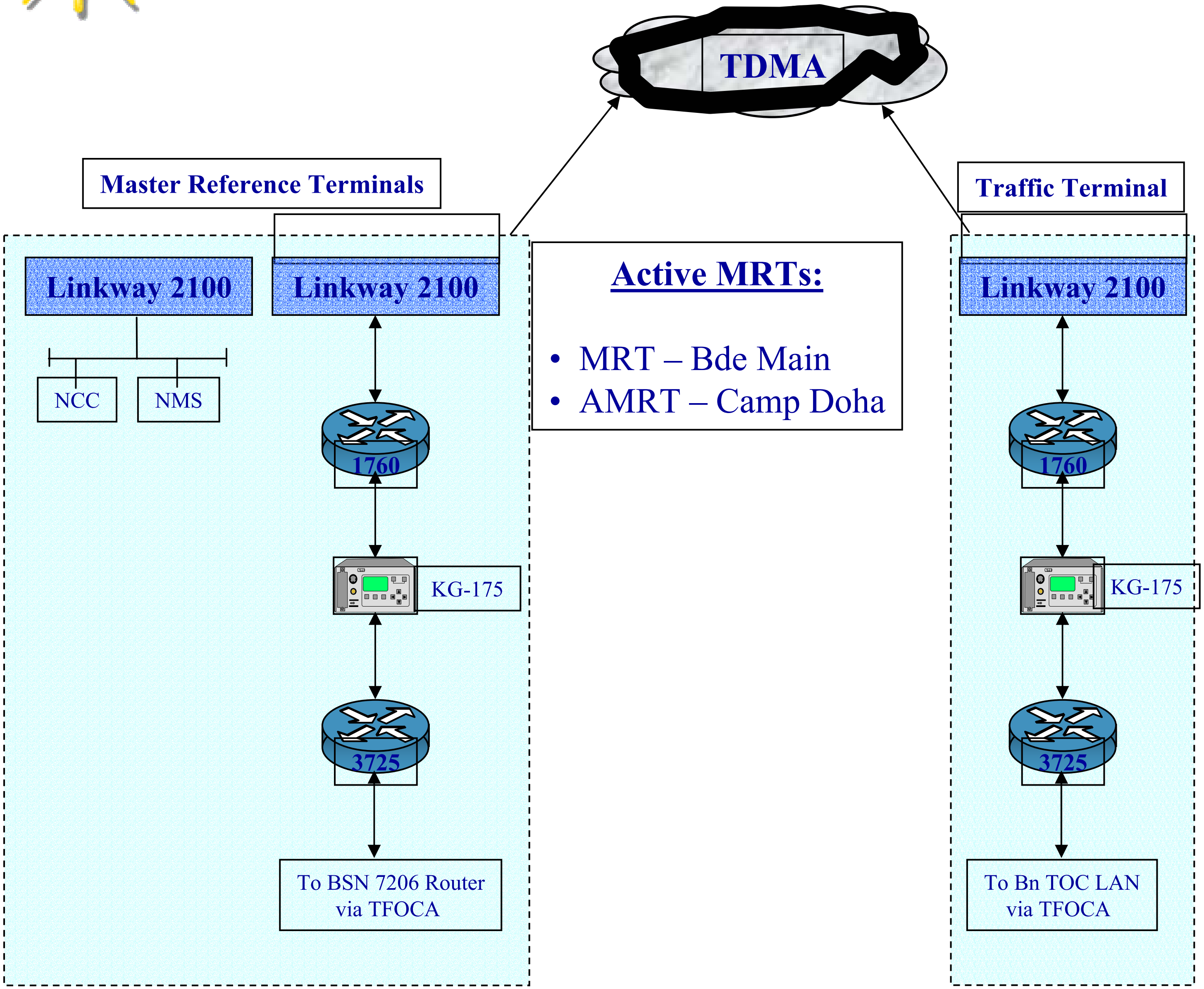


1st SBCT TDMA Network Topology



Active MRTs:

- MRT – Bde Main
- AMRT – Camp Doha

Active TTs:

- TT1 – 2/3 Infantry
- TT2 – 1/37 FA
- TT3 – 5/20 Infantry
- TT4 – 1/14 Cav
- TT5 – 1/23 Infantry
- TT6 – 44 CSB
- TT7 – Bde Fwd
- TT8 – 3/17 Cav
- TT9 – BSB
- TT10 - Bde Cdr
- TT11 - Spare